
Impact of DOCLINE on interlibrary loan service at the National Library of Medicine

By Eve-Marie Lacroix, M.S., Chief

Gale A. Dutcher,* M.L.S., Head, Systems Unit

Public Services Division
National Library of Medicine
8600 Rockville Pike
Bethesda, Maryland 20894

In March 1985, the National Library of Medicine (NLM) began implementation of DOCLINE†, its automated interlibrary loan request routing and referral system. By the end of fiscal year (FY) 1987, over 1,400 biomedical libraries in all seven regions of the Regional Medical Library network were using the system. This report summarizes the findings of an analysis of the interlibrary loan (ILL) requests received in FY 1987, comparing the results with a similar analysis done in FY 1984 to describe any changes in the requests or service which might be attributable to DOCLINE implementation. DOCLINE has had a substantial impact upon ILL loan service at NLM. An increase in the number of ILL requests (35% over FY 1984) can be attributed to the speed and ease with which requests may be routed to NLM through DOCLINE. Requests which cannot be filled by local or regional libraries are automatically routed by the system to NLM as the library of last resort. NLM's fill rate for serial requests has declined, however, from 78% filled in FY 1984 to 67% filled in FY 1987. Some of the decline results from the 11,000 requests that NLM did not fill because the borrowing libraries were not willing to pay the NLM charge for filling the loans.

INTRODUCTION

The National Library of Medicine (NLM) provides access to the largest collection of biomedical literature in the world—on-site in the reading rooms of the library in Bethesda, Maryland and off-site through its interlibrary loan service. In 1986 [1] and 1987 [2], NLM published reports analyzing the interlibrary loan (ILL) service provided during fiscal year (FY) 1984 (October 1, 1983, through September 30, 1984) and comparing the service provided that year with the activity in 1959. The differences found were linked to the major changes which had occurred in the biomedical library community and in NLM's ILL policies over the twenty-five-year period. These included the development of the Regional Medical Library network with its standards for resource sharing; the

growth of online access to biomedical literature, specifically NLM's MEDLARS network¹; and the development of SERHOLD² and other union lists.

In March 1985, NLM began implementing DOCLINE, the library's automated interlibrary loan request routing and referral system. The implementa-

* Now Technical Information Specialist, Specialized Information Services.

† DOCLINE, MEDLARS, SERHOLD, CATLINE, AVLINE, SERLINE, and *Index Medicus* are Registered Trademarks of the National Library of Medicine.

¹ MEDLARS is NLM's computerized system of over twenty databases, including MEDLINE (MEDlars onLINE) and its online backfiles, which contain nearly six million references to biomedical journal articles published from 1966 to date; CATLINE (CATalog onLINE)—approximately 630,000 references to books and serials cataloged at NLM; SERLINE (SERIALS onLINE)—bibliographic and preservation information for about 70,000 serials titles, including all journals on order or cataloged for the NLM collection; AVLINE (Audio Visuals onLINE)—citations to over 17,000 audiovisuals and computer-assisted instruction packages covering subject areas in the health sciences and cataloged by NLM.

² SERHOLD is NLM's database of machine-readable holdings statements for serial titles held by U.S. biomedical libraries, developed primarily to serve as the basis for DOCLINE. SERHOLD contains approximately one million holding statements for about 34,000 serial titles from over 2,500 health science libraries.

tion was completed in all seven regions of the Regional Medical Library network in May 1987. This article includes an analysis of the ILL service provided by NLM in FY 1987, comparing it where possible with the service provided in FY 1984, the last full year prior to DOCLINE implementation.

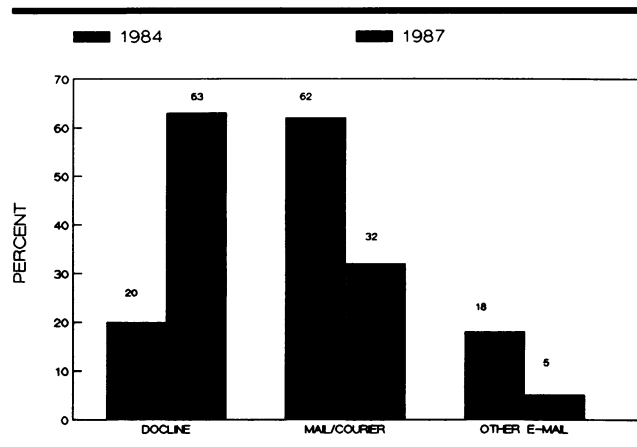
DOCLINE

DOCLINE uses SERHOLD—the national biomedical serials holding database—in conjunction with stored routing patterns provided by the individual libraries to route requests to interlibrary loan partners who report ownership of the item requested. In FY 1987, SERHOLD contained over 1,000,000 holdings statements for approximately 34,000 different titles held by over 2,400 biomedical libraries.

DOCLINE was inaugurated March 15, 1985 when the seven Regional Medical Libraries began to use the system. Because the routing system is based on replicating preexisting, regional, resource-sharing relationships, libraries began using DOCLINE region by region, with the final region added in May 1987. Currently, any library which contributes its serial holdings to SERHOLD may join the DOCLINE system. By the end of the 1987 fiscal year, 1,435 libraries were using DOCLINE.

DOCLINE allows users to create requests with the fewest possible keystrokes. The requester may key in the six-digit library identifier (LIBID); the system then automatically includes the institution's name and address in the ILL request. The requester may also use a MEDLINE, CATLINE or AVLINE unique identifier (UI) rather than entering the complete bibliographic information for a desired item; the system will then add the complete citation as identified by the UI. Users may alternatively enter the full citation manually. DOCLINE then automatically routes all journal requests containing a UI to a potential lender holding the requested journal title. The system routes requests only to libraries that have reported owning the item. If the request cannot be filled by the first library which receives it, the system automatically reroutes unfilled requests to another potential lender without any additional intervention by the requesting library. If the libraries in the borrower's routing table do not have the title or cannot fill the request, DOCLINE routes it to NLM. All requests that are not filled elsewhere are routed to NLM as the back-up library. During the 1987 fiscal year, 788,105 interlibrary loan requests were entered into DOCLINE by participating libraries. Fourteen percent of all requests entered into the system came to NLM. The remaining 86% were either filled, cancelled, or otherwise terminated by network users. Ninety-one percent of all the requests entered into DOCLINE were filled.

Figure 1
Mode of request transmission to NLM (in percentages)



ILL OVERVIEW

In FY 1987, 192,559 ILL requests were received by NLM for material in the general collection (publication date of 1914 or later). This number represents an increase of 35% over the 142,464 requests received in FY 1984. This growth is significant as it follows eight years of steady decline in the number of requests to NLM, from a high of 280,000 in FY 1977 to the FY 1984 low.

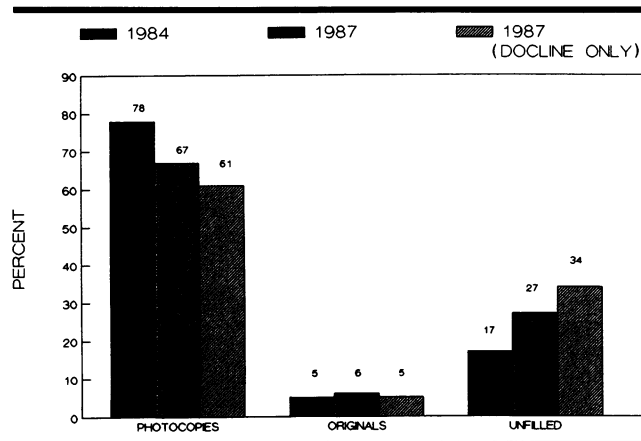
The mode of request transmission to NLM has also changed substantially since FY 1984 (Figure 1). By the end of FY 1987, 63% of all interlibrary loan requests were transmitted through DOCLINE, with an additional 5% via other electronic systems.

The pattern of disposition of ILL requests is quite different in FY 1987 from that reported in FY 1984 (Figure 2). In FY 1984 NLM filled 78% of requests as photocopies, 5% as loans of original materials, and was unable to fill 17% of requests. As reported in the earlier study, this pattern had not changed significantly in the twenty-five years between 1959 and 1984. In FY 1987, however, NLM was able to fill 10% fewer requests. The requests received through DOCLINE (58% of the total) were examined separately; of these NLM was unable to fill 34%. This study analyzed both the DOCLINE and nonDOCLINE requests received by NLM in FY 1987.

FILLED SERIAL REQUESTS

As in the 1984 study, the detailed analysis of filled serial requests was limited to those in machine-readable form. In 1987 there was a total of 118,611 such requests. The number of different SERLINE titles used to fill these requests was 11% higher in FY 1987 than in FY 1984; in FY 1987, 11,382 SERLINE titles were

Figure 2
Disposition of ILL requests (in percentages)



used to fill ILL requests at NLM; in FY 1984, 10,269 were used. Overall, 18% of the 64,221 active and ceased titles in the serial collection were used to fill ILL requests in FY 1987. This is slightly higher than in FY 1984, when 16% of NLM's serial titles were used.

The number of *Index Medicus* titles used to fill requests increased 5%, from 3,253 to 3,424; this is 88% of the 3,892 titles indexed for *Index Medicus* at some time in the past seventeen years. Of the titles indexed in *Index Medicus* which were not used to fill requests in FY 1987, 77% were closed titles. Several of the remaining eighty unused *Index Medicus* titles were new publications. Excluding these categories, nearly 99% of the *Index medicus* titles were used to fill ILL requests.

Of the 11,382 SERLINE titles used to fill requests in FY 1987, 3,424 (30%) are or were indexed in *Index Medicus* or its online version. An additional 3,984 (35%) are indexed by other major abstracting or indexing services.³ This differs only slightly from FY 1984, when 32% of the titles were indexed in *Index Medicus* and 36% in one of the other sources.

Table 1 lists the most heavily used serial titles. In general, NLM received the majority of the DOCLINE requests for the titles on this list. Most of the titles on the list were reported as owned by only a small number of libraries. Nineteen of the twenty-five titles were not reported as being held by even one library in every region. Seven titles on the current list were also among the twenty-five most heavily used in 1984, while eight of the titles began publication after the 1984 study.

³ *Chemical Abstracts, Biological Abstracts, Excerpta Medica, Science Citation Index, International Nursing Index, Hospital Literature Index, Psychological Abstracts.*

Table 1
Most heavily used serial titles in FY 1987

Title	ILLs
1. Italian Journal of Neurological Sciences	406
2. Journal of Nursing Staff Development	328
3. Australian Clinical Review	298
4. Auris, Nasus, Larynx	278
5. Asia-Oceania Journal of Obstetrics and Gynecology	270
6. Chemioterapia	262
7. National Institute on Drug Abuse Research Monograph Series	260
8. Nursing Standard	259
9. Annals of the Academy of Medicine, Singapore	256
10. Journal of Hypertension. Supplement	253
11. Medicina Clinica	231
12. Clinical and Experimental Obstetrics and Gynecology	228
13. Intensive Care Nursing	227
14. Professional Nurse	224
15. Journal of Post Anesthesia Nursing	217
16. Ricerca in Clinica e in Laboratorio	216
17. Journal of General Internal Medicine	216
18. Canadian Operating Room Nursing Journal	208
19. Gan To Kagaku Ryoho	208
20. Nursing Practice	207
21. Acta Europaea Fertilitatis	203
22. Progress in Clinical and Biological Research	201
23. Radiology Management	195
24. Journal of the Association of Physicians of India	184
25. Gerontion	179

As in FY 1984, analyzing the filled serial requests rather than simply the number of titles used highlights the significance of access through indexes. Of the 105,820 transactions examined, 62,626 (59%) were requests for articles from journals indexed in *Index Medicus* with an additional 31,945 (30%) from journals indexed in another major indexing publication. This is comparable to the results of the FY 1984 analysis, which showed that 60% of the requests were for articles from journals indexed in *Index Medicus*, and an additional 29% were for articles in journals indexed by one of the major indexing publications. In both years, only 11% of the requests were filled from a journal not identified as indexed.

Publication dates of serials used

Table 2 shows the dramatic drop-off in the number of requests for articles with publication dates earlier than 1980. Although the requests cover a very large date range, 78% of the requests have a publication date within the previous seven years. In FY 1984, 88% of the requests were for the most current fifteen years (1970-1984); in FY 1987, again 88% of the requests were for the most current fifteen years (1973-1987).

The requesting libraries

During the 1987 fiscal year, NLM filled serial ILL requests for 3,863 different libraries. This is an increase of 350 libraries (10%) over the number reported for FY 1984. The increase in the number of libraries receiving ILLs from NLM is equally distributed over

Table 2
Decade of publication of filled serial loans*—FY 1987

Decade	ILLs	(%)
1980	92,553	78
1970	14,893	13
1960	4,175	4
1950	1,734	1
1940	888	1
1930	630	1
1920	371	<1
1910	229	<1

* Year not always identified.

two categories, domestic and foreign addresses. Because the libraries requesting ILL service as part of the NLM/WHO (World Health Organization) agreement are included in the FY 1987 data but not in FY 1984 data, the increase in the number of foreign libraries was expected. The increase in use by domestic libraries is probably due to DOCLINE implementation.

In FY 1987, almost 46% of the filled serial loans were delivered to primary health care institutions in the United States, including hospitals and clinics, compared with 35% in FY 1984. Libraries affiliated with academic health sciences institutions—such as schools of medicine, dentistry, nursing and allied health—accounted for 18%, a decrease from 21% in FY 1984. Overall there was an increase from 70% in FY 1984 to 76% in FY 1987 in the percentage of loans filled for health-related libraries in the United States.

The large increase in the proportion of loans filled for primary health care institutions is almost certainly due to the implementation of DOCLINE. The system gives even the smallest hospital and clinic libraries automatic and rapid access to the NLM collection. Libraries which in the past might not have attempted to find the location for an item now need make no additional effort beyond typing the request.

Geographic distribution

North American requesters received the overwhelming majority of serial loans filled by NLM in both FY 1984 and FY 1987. The percentage, 92%, is an increase of 5% from that in FY 1984. There has been a decrease in the percentage of loans filled for institutions located in Asia and South America. It should be noted that during this period BIREME, the Pan American Health Organization's (PAHO) Latin American and Caribbean Health Sciences Information Center located in Brazil, discontinued financial support for ILL for Latin American libraries, which may account for the decrease in loans to the latter.

The distribution of filled serial loans within the United States appears in Table 3, organized according

Table 3
Regional distribution of filled interlibrary loans for serials

Regions	Libraries	ILLS	Average ILLs/Library	
			FY 1987	FY 1984
1. Greater Northeast	943	19,553	21	11
2. Southeastern/Atlantic Region	727	37,567	52	48
3. Greater Midwest Region	638	17,207	27	17
4. Midcontinental Region	293	9,356	32	26
5. South Central Region	166	7,873	47	29
6. Pacific Northwest Region	176	6,397	36	20
7. Pacific Southwest Region	479	9,815	20	13

to the Regional Medical Library network structure. For all regions and most states, there was an increase from FY 1984 in the average number of loans received per institution. The increase is lowest for Region 2, which includes NLM and the Washington, D.C. metropolitan area. Libraries in this area remain the heaviest users of NLM's collection, largely because NLM is a first resource for biomedical literature for U.S. government libraries in the metropolitan area.

UNFILLED SERIAL REQUESTS

In analyzing the FY 1987 data, it became clear that NLM's fill rate (i.e., the proportion of received requests NLM was able to fill) had decreased significantly during the three years since the previous study. This was especially notable since the fill rate had not changed to any extent in the twenty-five years between 1959 and 1984. It was also evident that the fill rate was markedly lower for requests forwarded through DOCLINE than for nonDOCLINE requests. To understand the causes for this decrease, data for all unfilled ILL requests were studied.

Table 4 shows the reasons NLM reported for not filling requests for serial loans in both FY 1987 and FY 1984. Twenty-seven percent of all the requests that NLM did not fill in FY 1987 were not filled because the borrowing library specified a limit on the amount they were willing to pay for a filled loan that was lower than NLM charges. NLM does not fill such requests, but immediately updates the DOCLINE request record to alert the user that the request is not being filled due to cost. The user may then resubmit the request indicating willingness to pay the charge. Prior to DOCLINE, requesters who were not willing to pay the ILL charge would not send their requests to NLM. If these 10,907 unfilled requests are eliminated from consideration, the percentages for the remaining reasons are more comparable to those reported for FY 1984. Clearly this category of unfilled requests has had an adverse impact on the overall fill

Table 4
Unfilled interlibrary loan requests for serials

Reason for not filling	FY 1987		% Excluding COST +	FY 1984*	
	#ILLs	%		#ILLs	%
Cost exceeds borrowers limit	10,907	27%	n/a	n/a	n/a
Not on shelf	5,855	14%	20%	2,533	16%
Title not owned	4,535	11%	15%	2,647	17%
Lacking (piece not owned)	3,883	9%	13%	2,584	16%
Incomplete/incorrect citation	3,088	8%	10%	1,607	10%
At bindery	2,767	7%	9%	1,443	9%
Not yet received	2,383	6%	8%	1,426	9%
In processing	1,447	4%	5%	766	5%
Noncirculating	1,300	3%	4%	768	5%
On Order	1,132	3%	4%	756	5%
Exceeds copy limits	577	1%	2%	251	2%
Cancelled at borrowers request	518	1%	2%	n/a	n/a
Lost	195	<1%	1%	152	1%
In use	145	<1%	<1%	177	1%
Lacks copyright compliance	108	<1%	<1%	169	1%
Poor condition	54	<1%	<1%	40	1%
Other	4	<1%	<1%	n/a	n/a
Unacceptable format/routing	2	<1%	<1%	383	2%
Unidentified reason	2,035	5%	7%	n/a	n/a
Total	40,889			15,702	
Total excluding COST	29,982				

* The data have been recompiled into the same nonavailable categories used in FY 1987. NLM started conforming to the proposed ANSI standard for nonavailable reasons February 2, 1987.

rate for NLM. The overall fill rate is 5% higher if these requests are not included in the calculations.⁴

When the adjusted percentages for FY 1987 are compared with those reported for FY 1984, there are only two categories which show notable differences. There is a 4% increase in items missing from the shelf in FY 1987. NLM processed 287,110 requests from reading room patrons in FY 1987, an increase of 36% over FY 1984. This increased on-site activity has adversely affected NLM's ILL service. The number of requests coded "Unacceptable format/routing" decreased from 383 in FY 1984 to only two in FY 1987; DOCLINE requests which route through users' routing tables are automatically acceptable to NLM. The 5% of requests for which no reason was coded is significant, but we cannot know what these reasons were; the database problem which caused these uncoded requests has subsequently been resolved.

The percentage of requests for titles not owned by NLM did not change significantly (15% in FY 1987, excluding COST, versus 17% in FY 1984); in FY 1987

the list contained 1,816 different titles. Those requested fifteen or more times are shown in Table 5. Of the twenty-five titles on this list, sixteen are owned by the American Hospital Association (AHA) and are available from the AHA Library. All but one title are in SERLINE because they are held by libraries within the regions who wish to report holdings on them. Most, if not all, of these titles appear to be out of the scope of the NLM collection according to the guidelines in the *NLM Collection Development Manual*, although they appear to contain articles of importance to hospital administrators and managers who are patrons of many health sciences libraries.

SUMMARY AND CONCLUSIONS

As in FY 1984, the ILL requests received by the National Library of Medicine in FY 1987 were primarily for articles published in serials. In FY 1987, NLM filled 67% of the ILL requests as photocopies, filled 6% as original loans, and did not fill 27% of requests received. This is an increase of 10% in unfilled requests over FY 1984. DOCLINE has become the main route for libraries transmitting their ILL requests to NLM; 63% of all requests are received via DOCLINE, and a total of 68% are received through electronic systems. Prior to DOCLINE implementation, only 38% of all requests were received electronically.

Both the total number of ILLs and the number of

⁴ In March 1987, DOCLINE was modified to stop rerouting of requests at the first library that charged more than the borrower was willing to pay. If these requests are excluded from consideration, the fill rate would be 8% higher for the five months prior to the modification and 4% higher for the seven months after the modification. In the first five months of FY 1988 (October 1987 through February 1988) exclusion of these COST requests would increase the fill rate by 4%.

libraries requesting them increased. The volume of ILL requests reaching NLM increased 35% from FY 1984 to FY 1987 after eight years of steady decline. There has been a significant change in the types of libraries requesting loans from NLM. Nearly half of the requests filled in FY 1987 were delivered to primary care institutions. There was also a general increase in the average number of loans to libraries in the United States, with no increase in those to foreign libraries.

As in FY 1984, *Index Medicus*, or its online version, and other indexing and abstracting publications were found to be very important in providing access to the biomedical literature. While only 18% of the serials collection was used to provide loans, 88% of the titles in *Index Medicus* were used. The majority of the 12% of *Index Medicus* titles not used to fill requests were closed titles. A total of 89% of all serial requests filled were for articles in titles indexed by NLM or other indexing and abstracting services.

DOCLINE has had substantial impact upon ILL service at NLM. Requests which formerly would not have been referred due to the time and effort required to do so are now reaching NLM. Larger numbers of libraries are using NLM's document delivery service, including libraries which may not have previously considered doing so. Libraries are also requesting more loans. DOCLINE makes it very easy to initiate and refer loans and thus encourages these changes.

Data for FY 1987 has shown that DOCLINE is largely responsible for a lowered fill rate due mainly to the large number of requests reaching NLM for which borrowers do not wish to pay. This has a minimal effect on requesters, however, because the requests are immediately returned via DOCLINE; the borrower may then choose to resubmit the request indicating willingness to pay the ILL charge.

This study has provided the National Library of Medicine with important data on the impact of the DOCLINE system on NLM's ILL service and pointed to specific areas where the DOCLINE system can be enhanced. It has also provided detailed information on the use of the serial collection and documenting the importance of indexing to the accessibility and use of the biomedical literature. Through DOCLINE more libraries are able to access NLM's vast collection

Table 5
Most frequently requested titles not owned by NLM—FY 1987

Title	ILLs	Notes
Business Insurance	75	AHA
NAACOG Newsletter	47	ANA
HPN Hospital Purchasing News	31	AHA
Risk Management	30	AHA
Laundry News	28	AHA
RCN Nursing Standard	28	ANA
Academy of Management Journal	27	AHA
IRCS Medical Science: Biochemistry	27	Regional Holdings
Medical Science Research: Biochemistry	27	Regional Holdings
Bibliotheca Medica Canadiana	26	On order
Focus on Family and Chemical Dependency	26	Regional Holdings
Executive Housekeeping Today	25	AHA
Employee Relations Law Journal	22	AHA
Journal of Health Care Marketing	19	AHA
Journal of Patient Account Management	19	AHA
National Journal	19	AHA
Academy of Management Review	18	AHA
Fund Raising Management	18	AHA
Caritas	17	ANA
Contact Dermatitis Newsletter	17	Unable to identify
Contract	17	AHA
Federal Register	16	Withdrawn
Organizational Dynamics	15	AHA
Personnel Administrator	15	AHA
Professional Safety	15	AHA

of biomedical literature quickly and to use it as a supplement to what is available in local and regional resources.

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